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ABSTRACT

In the early 1970s Lake Pedder was transformed from a very small natural lake to the present day lake, which now covers more square kilometres than any other body of freshwater in Australia. At that time the proposed course of action raised the concerns of numerous scientists with respect to the potential impacts the resultant significant expansion of the lake might have on the long-term survival of the known invertebrate species identified as being endemic to the original lake systems: in particular those in both Lake Pedder and Lake Edgar. In addition to the two endemic species of caddis-flies, which were re-discovered just over 10 years ago, the present study confirms the on-going existence of populations of two separate endemic phreatoicid crustaceans, variously referred to as being *Colubotelson* and *Uramphisopus*, as well as the endemic planarian, *Romankenkius pedderensis* Ball, 1974.

KEY WORDS

Phreatoicidae: *Colubotelson* and *Uramphisopus* as well as Dugesiidae: *Romankenkius*

INTRODUCTION

Originally Lake Pedder was a natural, shallow (at its deepest point 3 m), small glacial lake of approximately 9 km^2. In 1972 Hydro Tasmania completed a series of dams and thereafter the enlarged lake began to fill. Geographically Lake Pedder currently lies at 42°56' S and 146°08' E or alternately at Easting 429282 and Northing 5246224 (GDA94). The new lake (fig. 1) completely incorporates the tiny former Lake Edgar, which varied in size up to 1.4 km^2 and lay at 43°01' S and 146°20' E. At full supply, 308.93 m above sea level, Lake Pedder now covers 235 km^2, contains 3.3 km^3 of water, and at its deepest point, is 43 m. With reference to surface area Lake Pedder is now Australia's largest body of freshwater. However, the nearby Lake Gordon would be larger, at 274 km^2, were it ever to reach its full supply level, but in reality it typically contains less than half of its capacity.

When a marked expansion of the original Lake Pedder was mooted, concerns were raised with respect to the survival of no fewer than 17 endemic plant and animal species (Bayly *et al.* 1972 p. 48). Similar concerns were expressed by Johnson (1972 pp. 23 & 83) in relation to all endemic species. These scientists feared that many of the afore-mentioned species may have been threatened as a result of the consequences of the decision to create a much expanded Lake Pedder. More recently Lake (2001) listed five species of aquatic invertebrates, which were endemic to the original Lake Pedder system, whose fates remained of real concern. These invertebrates were as follows: (i) *Romankenkius pedderensis* Ball, 1974, a planarian, as well as two Trichopterans of the family Kokiriidae: (ii) *Taskiria mccubbini* Neboiss 1977, McCubbin's caddisfly, as well as (iii) *Taskiropsyche lacustris* Neboiss, 1977, the Lake Pedder caddis-fly, and finally, in addition, two isopods of the family Phreatoicidae: (iv) the isopod found in Lake Pedder and lastly, (v) an unpigmented isopod which Lake (2001 p. 88) states was 'found only in Lake Maria and Lake Edgar'. In 10 surveys

of the expanded Lake Pedder, which were conducted between 1975 and 1989, Lake (2001) states that not one of these five endemic species just mentioned was collected. Finally, however, it is important to note that Lake (2001) drew attention to work reported by Tyler *et al.* (1994) (see also Tyler *et al.* 1996) in which specimens reported as being *Uramphisopus* sp. (identified by PS Lake and A Glaister see Table 2 p. 356 in the latter article) were successfully isolated in 1993 by scuba divers from the still-intact, albeit submerged, beach of the original Lake Pedder. According to Tyler *et al.* (1994) when referring to species that might have been affected adversely by the flooding of the original Lake Pedder, 'An assessment today of the fate or current status of these species is beggared by the fact that some of them never were officially published in the scientific literature. The matter is aggrevated [sic] by the fact that no collections of some species were preserved.'

Of the afore-mentioned five aquatic invertebrate organisms endemic to Lakes Pedder and Edgar, the two caddis-flies have subsequently been collected from the expanded Lake Pedder in a survey conducted by Jackson, who was assisted by B Mawbey (Jackson, 1999 & 2000). Two male *T. mccubbini* were collected in November of 1998 from a UV light trap that had been set on the shore line of Coronation Peak not far from the original Lake Pedder. Soon thereafter, in January of 1999, a single male *T. lacustris* was isolated, again from a UV light trap, which this time was set up close to Ted's Beach near the north-eastern extremity of Lake Pedder as it is today (fig. 1). The specimens were classified by D Cartwright and thereafter were referred to A Neboiss, who confirmed their identifications (Jackson, 1999 & 2000). No attempts were made to collect either of the afore-mentioned caddisfly species in the present study. Although the two endemic caddisflies were not a focus of this survey, no one should be left in doubt that they both are, and as far as the literature reveals, probably always were, rare species. Indeed, Smith and Gilfedder (1993) considered both of these species of caddisflies to be endangered. In neither species has a female ever been collected for subsequent taxonomic descriptions. In addition, from our search of the literature, between the two species a mere total of nine males has been collected: four of *T. mccubbini* and five of *T. lacustris*!

The discovery of a phreatoicid from the original Lake Pedder was recorded in the literature first by Bayly *et al.* (1966). Therein it is stated that the phreatoicideans they sampled were estimated subjectively to be abundant (*ibid.* see Table 1 on p. 36). They also described this phreatoicidean as being the first within this suborder to be found living as an interstitial organism (p. 36). Bayly *et al.* (1972) report that the phreatoicidean that lives in the sands of Lake Pedder is always pigmented, but that it displays varied pigmentation with most specimens being darkly coloured (see pp. 45-46). More recently Bayly (1973) classified them as being in the family Phreatoicidae and genus *Colubotelson* and reported that they were present in large numbers. Later Knott and Lake (1974) reported the presence of a benthic phreatoicid that they collected in moderate numbers (see Table on pp. 10–11), from a 'vegetation free, bottom ooze' in Lake Edgar. Those specimens were pigmented and eyes were present. In the same article (p. 12) Knott and Lake state that the benthic isopods from Lake Edgar, which they labelled species A, belong to the genus *Colubotelson*. In addition, these authors state that 'species A is identical to the pigmented form from Lake Pedder'. The taxonomy of these species was later complicated by a proposed synonmy in an unpublished thesis (Knott, 1975) of *Colubotelson* with the monotypic genus *Uramphisopus* which is too inclusive (GDF Wilson, 2010 personal communication). The generic composition for the Phreatoicidae established by Nicholls (1944) is used here as the ICZN does not recognise taxonomic acts in unpublished theses (GDF Wilson, 2010 personal communication).

Additionally, Knott and Lake (1974), refer to a non-pigmented, blind phreatoicid that lived (i) amongst wet reed beds that were present along the shoreline of the former Lake Edgar and (ii) in nearby yabby holes. On the basis of Knott and Lake (1974), Lake (2001 p. 88) refers to 'an unpigmented phreatoicid isopod found only in Lake Maria and Lake Edgar' which he identified as *Uramphisopus* sp. 2 (refer to Table 1 in Lake, 2001). We consider that this species probably belongs to the genus *Colubotelson*.

Four specimens of this unpigmented phreatoicid were collected by J Fenton (27.12.74) at Arthur Plains (Knott, 1975 p. 118) approximately 10 km from Lake Edgar. All phreatoicid species that belong to the genus *Colubotelson*, however, are pigmented to some degree and have eyes, so the identity of the blind, unpigmented species is uncertain. The only phreatoicideans known from Tasmania that are blind, unpigmented and live interstitially or in yabby burrows are members of the family Hypsimetopidae (specifically *Phreatoicoides*), which are unlikely to be confused with Phreatoicidae (GDF Wilson, 2010 pers. comm.). A blind, unpigmented phreatoicid belonging to a new genus is known from caves in Southern Tasmania (A Clarke, 2010 pers. comm.), but this species is also easily differentiated from *Colubotelson*. Difficulties such as these with respect to the phreatoicideans in and around the environs of the original Lake Pedder and the former Lake Edgar, as well as within the Arthur Plains, have arisen in no considerable part because of the lack of taxonomic descriptions of these species. Presumably our inadequate knowledge of the taxonomy in these lesser studied groups was precisely what led Fulton and Tyler (1993 p. 111) to make the following valid observation: 'there is little capacity to comment on the occurrence of localised, rare, or endangered species of freshwater invertebrates in the WHA' (in this article those authors use WHA as an abbreviation for the World Heritage Area).

Thus, the literature is confused with respect to the two aquatic phreatoicideans, one each of which is known to have occurred naturally in both the original Lake Pedder and Lake Edgar. Therefore the present survey concentrated upon attempts to (i) collect and, if successful, thereafter (ii) clarify the correct classification of the phreatoicids isolated from both (a) the psammon living in sand in the bed of the former Lake Pedder and (b) the ooze submerged beneath the current Lake Pedder, but which originally lay at the bottom of the former Lake Edgar.

The other endemic species that was sought in the present study was that of the planarian, *Romankenkius pedderensis*. Importantly, however, it should be noted that on several occasions *R. pedderensis* was recorded as being 'extinct?': IUCN:1986, 1988, 1990 & 1994 see (Groombridge 1994). Thereafter in 1996 *R. pedderensis* was formally classified as being extinct (Baillie & Groombridge 1996 p. 192). In that same monograph in Annex 7, extinct is defined as follows: 'A taxon is extinct when there is no reasonable doubt that the last individual has died'. Fulton (1989 p. 251) argued 'A species should only be listed in a category of some significance if it has received sufficient taxonomic treatment and adequate collections or observations have been made to confirm its identity and determine its distribution with reasonable certainty'. Michaelis (1985 pp. 1–2) used IUCN definitions for extinct, endangered, vulnerable and rare organisms when providing details of rare or threatened species from Tasmanian inland waters. Thus readers of that article should not be surprised to find that no mention is made therein of *R. pedderensis*, nor of it having been classified as being extinct. In addition, we have been unable to find any reference to researchers who have mounted a search specifically for this species in Lake Pedder after 1972. This is so because, when referring to a series of previous surveys of Lake Pedder for aquatic invertebrates, Lake (2001 p. 94) stated. 'Given our method of sampling it is not surprising that the endemic flatworm was not collected'.

MATERIALS AND METHODS

Phreatoicid Studies:

A dredge that was 110 cm wide with a 15 cm tall opening was built to drag behind a boat so that sand or ooze respectively along with phreatoicids could be retrieved from the substratum of: (a) the original Lake Pedder and (b) the former Lake Edgar which now lie metres beneath the current surface of Lake Pedder.

On 14 February 2010 the present authors made use of detailed maps and photographs to assist the coxswain to position the boat so that it was above the submerged bed of the original Lake Pedder (Plate 1). Many dredges were attempted approximately where, in March of 1972, Bayly (1973) collected phreatoicids. Strong south-

east winds made sampling the benthos difficult. Furthermore, our dredge frequently encountered submerged dead shrubs and trees.

The following day, 15 February 2010, we employed the same techniques mentioned previously, this time to position the boat accurately over the bed of the former Lake Edgar which lies at 43° 01' S and 146° 20' E.

Planarian Studies:

The authors searched unsuccessfully for the planarian, *R. pedderensis,* while looking under many rocks along extensive shore lines of Lake Pedder at numerous, widely separated locations including some at: (i) Sprent Basin, (ii) Strathgordon Bay, (iii) Hermit Basin and (iv) Scotts Peak Dam. Thereafter we centred our studies for relocating populations of *R. pedderensis* along existing shorelines, as close to the original Lake Pedder as is possible, as well as to adjacent benthic sites. Samples were collected from the latter sites during 13 and 14 April, 2010. It is well-documented that freshwater planarians are attracted to raw meat. We used two different traps: (i) burley baskets in which small bones from a butcher's shop were inserted and (ii) plastic drink bottles, through which had been drilled 25 holes each 4 mm in diameter, that were distributed relatively evenly around the surfaces. A small amount of chicken mince was inserted in the lids of these bottles. That bait was held in place by fibreglass fly wire. Regardless of design, each trap was held on the bottom with weights and those along shorelines were tethered to plants or to rocks by ropes. Those lowered to meaningful depths in the afternoon were attached individually to a separate buoy for subsequent retrieval. During the working day we set a total of 25 traps baited in the manner just described along the northern shoreline, that is approximately 1 km west of the now submerged beach of the original Lake Pedder. A further 15 traps were set along the southern shoreline. Late in the afternoon all baited traps were harvested and then they were redeployed; some at depths of between 6–9 m approximately 25 m offshore from the previously described northern shoreline. In addition, similar traps were set on the substrate approximately halfway between the existing shorelines, so as to be positioned approximately in the middle of the original Lake Pedder.

Planarians trapped in this survey subsequently were photographed at Strathgordon with the aid of a camera mounted on a dissecting microscope. Those planarians that bore a remarkable resemblance to the external morphological features, as described by Ball (1974), for *R. pedderensis* were killed by fixing them in Carnoy's fluid for 20 minutes and immediately thereafter they were transferred to 70% ethanol. Specimens fixed and preserved in that manner were subsequently embedded and serial sections were made at two separate laboratories in Launceston: (i) The University of Tasmania and (ii) The Mount Pleasant Laboratories of the Tasmanian Department of Primary Industries, Parks, Water and Environment. More than 40 of these slides were examined under high-power light microscopy.

Lodgement of specimens:

Specimens of *Colubotelson* sp. 1 and *Colubotelson* sp. 2 collected during this study have been placed in the Queen Victoria Museum and Art Gallery in Launceston and have been assigned the following registration numbers: QVM:10:51195 and QVM:10:51196 respectively. The histological slides of the triclad *R. pedderensis* that were produced and studied in the present study also have now been deposited with the Queen Victoria Museum and Art Gallery in Launceston and have been assigned the following registration numbers: QVM:19:4207-4210.

RESULTS

(i) Searches for the phreatoicidean isopods endemic to the original Lake Pedder and the former Lake Edgar

(i a) Field Studies:

While working over the bed of the original Lake Pedder we collected a single sample of 271.6 g (when dried) of pink sand from a depth of 14.2 m. From the afore-mentioned sample, we isolated and preserved eight adult phreatoicideans. Given that an unknown quantity of smaller particles of sand would have been lost during retrieval of the sample from the bed of the lake, the densities of the phreatoicidean population cannot be ascertained in relation to the original quantity of sand removed from the benthos. Nevertheless, at the site from which this sample was obtained, it is clear that these small crustaceans were possibly present in relatively large numbers. At the time of collecting, we classified the isopods as being *Colubotelson* sp. 1. Both genders were represented from within this small sample.

Thereafter, while working above the bed of the former Lake Edgar, from a depth of 9.2 m we brought up approximately two litres of ooze from the substratum with our very first dredge. Well over 100 phreatoicideans, which we referred to as being *Colubotelson* sp. 2, were present in the sample with both genders being well represented.

(i b) Results:

When viewed dorsally, adult phreatoicideans collected from Lake Pedder, clearly display a light pink pigmentation (fig. 2). When viewed laterally, (fig. 3) again they are slightly pink, while also displaying a markedly mottled appearance; concurrently the alimentary canal is obscured. Lake's (2001) observation that the exocuticle of the phreatoicid he refers to as being '*Uramphisopus* sp. 2' from the former Lake Edgar was un-pigmented is hard to reconcile. This is so because, when viewed from above our specimens, from the bed of what was originally Lake Edgar, clearly display darkly pigmented heads, although the rest of the exocuticle is effectively devoid of pigmentation (fig. 4). When one views our specimens of the 'Lake Edgar' phreatoicidean from a lateral perspective the head capsule is always a mottled brown with a dark patch between the eyes that extends downwards toward the mouthparts (fig. 5). In the same figure behind the head capsule one distinctly observes the alimentary canal. The pleotelson and uropods, as well as the propodus of pereopod IV of a ♂ of both species, appear in figures 6a, *Colubotelson* sp.1, and 6b, *Colubotelson* sp.2. From the respective samples in the present study, both genders of the species that originated in Lake Pedder are more robust than are those of the species that occurs in the bed of the former Lake Edgar.

The mean length of the Lake Pedder phreatoicidean adults (n = 8), that we collected in the present survey, was 8.06 mm while that of the former Lake Edgar phreatoicidean adults was 7.79 mm where n = 100. GDF Wilson (pers. comm.) confirmed that both species do belong absolutely to the genus *Colubotelson*.

(i c) Discussion:

Initially, we had tentatively classified both of our samples of phreatoicideans as belonging to the genus *Colubotelson*. When we followed the key developed by Wilson & Keable (1999), these two populations of phreatoicideans from different geographical locations were both assessed by us definitely as belonging to the genus *Colubotelson*, which is a very common taxon indeed in Tasmania. As such we were in agreement with the findings of Bayly (1973), who had referred to the Lake Pedder phreatoicideans in the psammon community as belonging to the genus *Colubotelson*. We are therefore in disagreement with Knott (1975), Tyler *et al.* (1994 & 1996), and more recently with both Lake (2001), as well as Tyler (2001) as to the generic classification of these species.

Both isopod genera, *Colubotelson* and *Uramphisopus* (sub-order Phreatoicidea and the family Phreatoicidae), are found in Tasmania. The original Lake Pedder and Lake Edgar phreatoicids however cannot be placed in the genus *Uramphisopus* (see Table 1), because

their respective uropod dorsomedial lobes are small and rounded whereas in the genus *Uramphisopus* the afore-mentioned lobes project considerably in a manner similar to the condition seen in the Amphisopidae which do not occur in Eastern Australia (Wilson 2008). Wilson (2005) reiterated that there is but one species in the genus *Uramphisopus* recognised in Tasmania: that of *U. pearsoni*. Therefore, to date, the Tasmanian genus *Uramphisopus* is monotypic: the type species being *U. pearsoni*, recorded only from Great Lake (Nicholls 1943) on Tasmania's Central Plateau.

In addition, according to Knott (1975 p. 117), the largest Lake Pedder phreatoicidean he recorded was 8.9 mm long. Our largest specimen, of what we report herein as being *Colubotelson* sp. 1, measured 8.6 mm in length. Considering our small sample size and the fact that samples of adults were collected more than 35 years apart, albeit from the same sandy substratum, the maximum recorded lengths of these archaic isopods are remarkably similar. Furthermore, from the description provided by Knott in his PhD thesis (1975 pp. 116 & 117) and the associated drawings therein (fig 5.8) of what was previously known as *Colubotelson* sp. 1, the specimens we collected from Lake Pedder in 2010 appear to be identical.

Most significantly, the specimens of *Colubotelson* sp. 2, which we also isolated successfully in 2010, were deemed to be identical (GDF Wilson, 2011 pers. comm.) to those collected by A Neboiss from the original Lake Pedder in 1972. The relevant samples provided by Museum Victoria are as follows: (i) NMVJ44909, 10/03/72, 1 specimen and (ii) NMVJ44903, 10/03/72, 6 specimens. The geographical co-ordinates recorded for these samples are: 42°50' S and 145°59' E and they are recorded as coming from the 'eastern shore of Lake Pedder'. These museum samples could well explain why Knott and Lake (1974) stated (p. 12) that the benthic isopods from Lake Edgar, which they labelled species A are 'identical to the pigmented form from Lake Pedder'.

It is very important to note that there were two other samples of phreatoicids collected by Neboiss from Lake Pedder that were also provided to us by Museum Victoria: (i) NMVJ44902, 12/03/72, 6 specimens and (ii) NMVJ44908, 31/01/65, 6 specimens. All 12 of these specimens are totally different to any descriptions in the literature and furthermore, they belong to a yet to be described genus within the family Phreatoicidae (GDF Wilson, 2011 pers. comm.).

(ii) Searches for the planarian, *Romankenkius pedderensis*, endemic to the original Lake Pedder

(ii a) Field Studies:

Both trap designs and types of meat baits worked well. Few triclads were caught along the southern shoreline. A strong wind, however, was blowing all afternoon and that, coupled with meaningful wave action, may have markedly adversely affected the success rate of traps along that shoreline. No triclads were retrieved from traps set in the middle of the original lake basin. Traps set along the northern shoreline, both in the shallows and in deeper waters up to 25 m off shore, were the most productive. Indeed, four species of freshwater triclads were found to be present from many of those sites. The geographical co-ordinates for the afore-mentioned sites where traps were deployed successfully are: Easting 432770 and Northing 524514 (GDA94) or 42°56' S 146°10' E. The co-ordinates of the type locality provided by Ball (1974) are 42°55' S 146°07' E. From preliminary observations of external morphological features, it appeared highly likely that *R. pedderensis* had been collected from a not inconsiderable number of those traps. However, until detailed histological studies were undertaken, the presence of this endemic species could not be confirmed absolutely.

(ii b) Results:

The histological slides of triclad specimens collected from near the bed of the original Lake Pedder during the course of the present study display the following features as defined by Ball (1974) for *R. pedderensis*: (i) the presence predominately of ventrally positioned testes and ovaries that lie above or medially to the ventral nerve cords (fig. 7) and with respect to the copulatory apparatus which appears in (figs

8, 9 & 10) note in particular (ii) the absence of a prostatic vesicle. Critically, the histology of the specimens collected in the present survey matched that of the paratype specimens kindly lent to us by the Royal Ontario Museum. In particular we observed the distinguishing anatomical features of *R. pedderensis* as described by Ball (1974) on the following histological slides: Lot 19901 108 Acc 1990-054 ROMCN C14, C17, C18 and C19. In addition, the histology of our specimens also reveals that the diverticulum/common oviduct originates from the common atrium (fig. 10) as described by Sluys (1997) following his re-examination of the holotype of *R. pedderensis*. Secondly, and most importantly, according to Grant *et al.* (2006 p. 451), the diverticulum/common oviduct of *R. pedderensis* arises from the bursal canal and at the apex of the copulatory bursa a connection occurs with the intestine (see also Grant *et al.* 2006: fig. 33). The afore-mentioned morphological arrangements are likewise supported histologically herein (fig. 10), where the diverticulum can be seen to be enter the proximal ventral section of the bursal canal and additionally the intestine appears within the bursal canal.

When preserved, the triclads we isolated in the present survey display the relatively small size of preserved specimens (viz.: 8x2 mm) (Ball, 1974), as well as possessing the following external characteristics: (i) a small un-pigmented area surrounding each eye, i.e. not being much larger than the eye itself, (ii) the presence of pit-like anterior auricular slits, (iii) eyes which are relatively close to the anterior margin of the animal and (iv) the dorsal surface was reported to be uniformly grey-brown in colour (fig. 11). However, in living specimens of *R. pedderensis* we observed not only grey-brown individuals but also some which were yellow-green (fig. 12). Living specimens of this species were measured up to 16 mm in length and 7.5 mm in width, but clearly not concurrently.

Combined, all the afore-mentioned histological and external morphological features confirm that, as at April, 2010, a population of *R. pedderensis* still existed in the expanded Lake Pedder (see Table 1) some 38 years after Lake Pedder was expanded massively.

(ii c) Discussion:

A far more detailed survey would be required in order to define the current distribution of *R. pedderensis* within the present lake. From our very preliminary investigations at several widely distributed sites around the perimeter of the new Lake Pedder, we were unable to demonstrate that this species has indeed expanded its distribution meaningfully. For an entire day we carefully searched shorelines adjacent to Scotts Peak Dam in both directions and failed to isolate a single specimen of *R. pedderensis*. Far more field work needs to be undertaken to clarify the true situation but, for the time being, one would tentatively embrace the hypothesis that populations of *R. pedderensis* have yet to disperse meaningfully from where they originated. In a much larger study of invertebrates in both Great Lake and Arthurs Lake following their expansion, Fulton (1983 p. 799) reported that restriction of certain species to their original areas might be as a result of (i) substrate preferences but could also be due to (ii) low mobility.

Neither are we in a position to comment on an estimation of the size of the existing population. This is so because our present study was so very constrained. Nevertheless, *R. pedderensis* was collected in reasonable numbers at numerous sites — albeit all in relative proximity to one another and very close to the site from which the species was first collected on 11 March of 1972 by IAE Bayley [sic] Ball (1974).

CONCLUSION

We have successfully collected from the expanded Lake Pedder both phreatoicidean isopods (described in some articles in the literature post 1974 as being '*Uramphisopus* sp. 1' and '*Uramphisopus* sp. 2'). We also resolved the confusion that has persisted in the literature confirming that Bayly (1973) was indeed correct when, on advice from B Knott (see p. 306), he placed the endemic phreatoicidean from Lake Pedder in the genus *Colubotelson*. Furthermore it is shown that the phreatoicidean once thought to originate in Lake Edgar, namely *Colubotelson* sp. 2, prior to the expansion of Lake Pedder, as well as *Colubotelson* sp. 1 needed to be and

must be left in that genus until, if ever, being formally transferred to another genus in a refereed, published scientific article. We have unequivocally demonstrated that *Colubotelson* sp. 2 has continued to thrive, as evidenced by the more than 100 specimens being present in a sample of two litres of ooze, albeit collected at a much greater depth than prior to inundation. Given that *Colubotelson* sp. 2 had been recorded from ooze in Lake Edgar, it was far less likely to have been adversely affected by modified siltation patterns in the new lake should that have occurred. In the expanded lake, the situation with respect to possible adverse effects of changes in siltation patterns on populations of the benthic species of phreatoicidean (viz.: *Colubotelson* sp. 1) was more of concern. However, although Tyler *et al.* (1996 p. 354) reported that the former Lake Pedder beach 'was overlain by about 3 mm of fine sediment', the present authors did not retrieve any such sediment of dy on top of the former lake substrate of sand. Given our method of sampling, the dy, if it were present, could simply have been washed away in the retrieval process. Finally and very importantly, neither of these research groups experienced difficulty in isolating a meaningful number of phreatoicids from retrieved psammon.

From our precursory field work on *R. pedderensis,* the most efficient method employed to date to collect these dugesiids is by traps baited with small amounts of uncooked meat. However, a detailed analysis of habitat preference of *R. pedderensis* needs to be undertaken. Furthermore, one should definitely set traps at locations distributed widely throughout Lake Pedder and such a detailed survey should include trapping at considerable depths. Once again, from our very preliminary overall successes coupled with some failures at deeper sites to trap this species, such a study may possibly demonstrate that *R. pedderensis* shuns muddy substrata in favour of rocky ones.

Our surveys were conducted under difficult weather conditions and time constraints. Therefore, additional field studies are necessary on all the invertebrates surveyed herein in order to establish: (i) an accurate understanding of the distribution of these species within the new lake and (ii) gain reliable data with respect to (a) population estimates and (b) habitat requirements.

Future studies will reveal whether the species, which we relocated in the present study, show a marked preference for the substrates in which they were found in their original lake beds, as was the case with respect to some species studied in Great Lake and Arthurs Lake as reported by Fulton (1983 p. 799). In the same study, Fulton (p. 787) indicated that closer relationships exist between fauna in the original lake systems from those in the newly flooded areas and that this distinction could not be attributed to depth, but may have been influenced by differences in substrates.

With respect to the five endemic species of aquatic invertebrates either discussed herein: i.e. the two species of caddisflies (Jackson, 2000) and/or the three species that we set out to isolate within the present study, we can now state with considerable confidence that none of them has become extinct from Lake Pedder. Several reports of potential extinction have been made: (i) Johnson (1972 p. 23) 'It follows that the flooding of Lake Pedder will almost certainly result in the extinction of several species presently known only from that lake.', (ii) Bayly *et al.* (1972 p. 48) to the effect that 'It is unlikely that many of the species at present found in and near Lake Pedder would survive in the artificial impoundment created by the flooding.' as well as (iii) the statement by Lake (2001 p. 87) that 'Four species of endemic animals have disappeared'. However, people on all sides of the debate pertaining to whether or not the original Lake Pedder should, or should not have been flooded can now take pleasure in the knowledge that the invertebrate species for which so much genuine concern was expressed historically almost certainly still persist.

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TABLE 1

Classification and status of aquatic invertebrate species which were known to be endemic to the original Lake Pedder system.

CLASSIFICATION:			
Phylum	Platyhelminthes		
Class	Turbellaria		
Order	Tricladida		
Family	Dugesiidae		
Genus	*Romankenkius*		
Species	*pedderensis* Ball 1974		
STATUS: UCN LISTS AS: EXTINCT? From 1986 to 1994 and as extinct since 1996.		Forteath & Osborn Present in Lake Pedder in 2010.	
CLASSIFICATION:			
Phylum	Arthropoda		
Sub Phylum	Crustacea		
Class	Malacostraca		
Order	Isopoda		
Family	Phreatoicidae		
Genus	*Colubotelson* sp. (Bayly, 1973) & (Knott & Lake, 1974)		
	Uramphisopus baylyi (Knott 1975)	*Uramphisopus* sp. 1 (Lake 2001) & (Tyler 2001)	*Colubotelson* sp. 1 Forteath & Osborn, present article
STATUS: *Uramphisopus* sp. 1 (Tyler et al. 1994 & 1996) Present in Lake Pedder in 1993		and, more recently: *Colubotelson* sp. 1 Forteath & Osborn, present in Lake Pedder in 2010	
CLASSIFICATION:			
Phylum	Arthropoda		
Sub Phylum	Crustacea		
Class	Malacostraca		
Order	Isopoda		
Family	Phreatoicidae		
Genus	*Colubotelson* sp. (Bayly, 1973)	*Uramphisopus* sp. 2 (Lake 2001)	*Colubotelson* sp. 2 Forteath & Osborn, present article
STATUS: *Colubotelson* sp. 2 Forteath & Osborn Present in Lake Pedder in 2010			
CLASSIFICATION:			
Phylum	Arthropoda		
Class	Insecta		
Order	Trichoptera		
Family	Kokiriidae		
Genus	*Taskiria*		
Species	*mccubbini* Neboiss 1977 (pp. 81-82)		
STATUS: Smith & Gilfedder (1993, p. 139) endangered		Jackson (1999 & 2000) Present at Lake Pedder	
CLASSIFICATION:			
Phylum	Arthropoda		
Class	Insecta		
Order	Trichoptera		
Family	Kokiriidae		
Genus	*Taskiropsyche*		
Species	*lacustris* Neboiss 1977 (pp. 82-83)		
STATUS: Smith & Gilfedder (1993, p. 139) endangered		Jackson (1999 & 2000) Present at Lake Pedder	

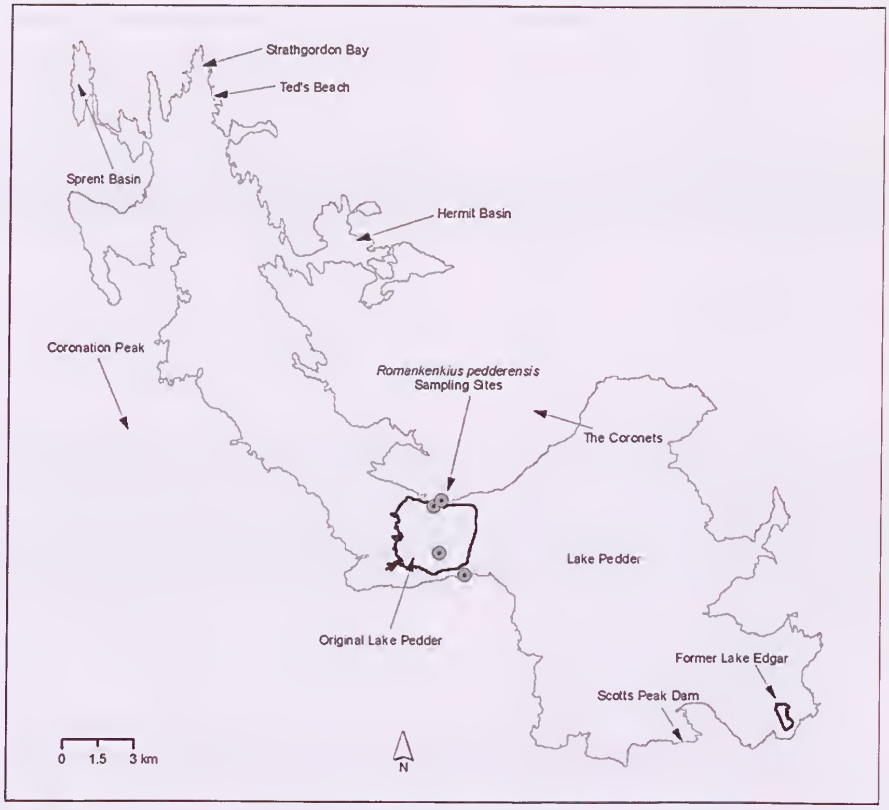

FIGURE 1.
Map of Lake Pedder as it is today with the shorelines of both the original Lake Pedder and the former Lake Edgar being depicted in bold black. In addition, sites where sampling for the Lake Pedder planarian, *Romankenkius pedderensis,* was undertaken are identified.

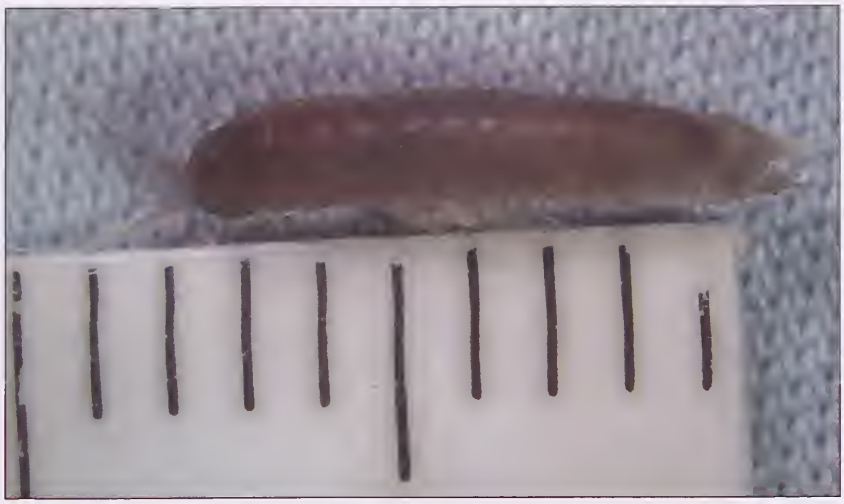

FIGURE 2.
Dorsal view of *Colubotelson* sp. from psammon substrate of Lake Pedder. Note: pink colouration. Scale in mm.

FIGURE 3.
Lateral view of *Colubotelson* sp. from psammon substrate of Lake Pedder. Note: (i) pink colouration and (ii) mottling, as well as an obscured alimentary canal. Scale in mm.

FIGURE 4.
Dorsal view of *Colubotelson* sp. from ooze in the bed of the former Lake Edgar. Note: (i) the dark brown mottling between the eyes. Scale in mm.

FIGURE 5.
Lateral view of *Colubotelson* sp. from ooze in the bed of the former Lake Edgar. Note: (i) the brown mottling both above the obvious eye and beneath the eye toward the mouthparts as well as (ii) a prominent alimentary canal running the length of the body. Scale in mm.

FIGURE 6A.
Specimen of ♂ *Colubotelson* sp. 1. showing entire specimen (top). Inset on left: pleotelson and uropods — inset on right: propodus 1 of pereopod IV, left side, distal podomeres showing setation on propodus.

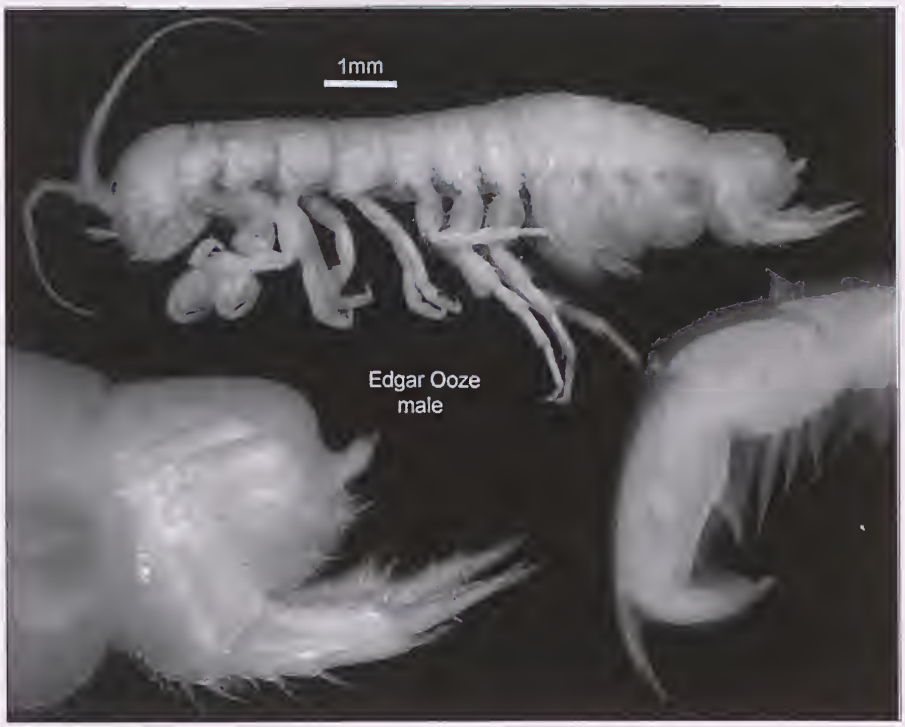

FIGURE 6B.
Specimen of ♂ *Colubotelson* sp. 2. showing entire specimen (top). Inset on left: pleotelson and uropods — inset on right: propodus 1 of pereopod IV, left side, distal podomeres showing setation on propodus.

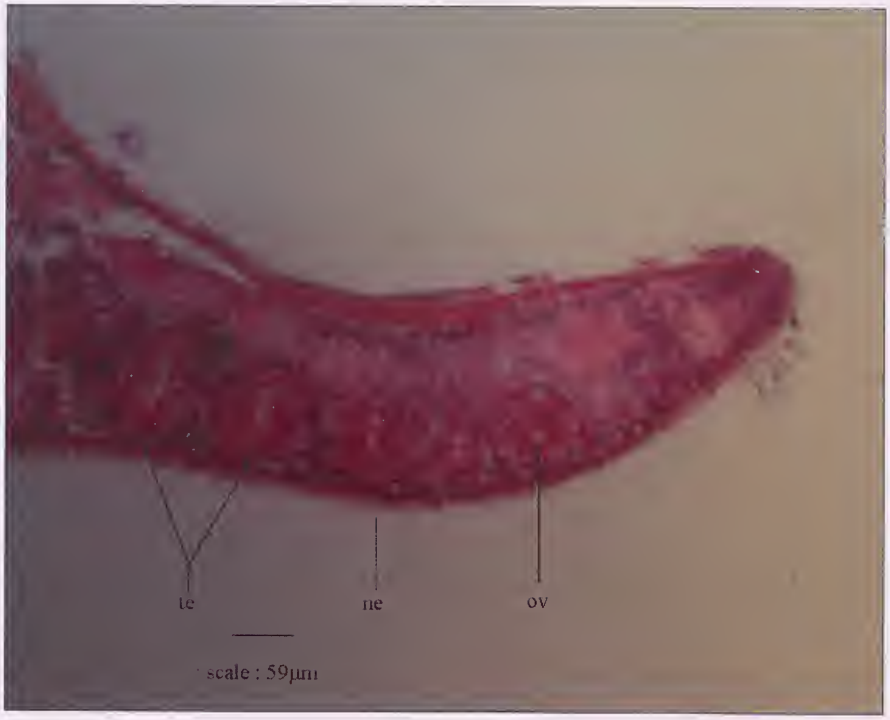

FIGURE 7.
Saggital section of both of the testes and ovary of *Romankenkius pedderensis* viewed from the left side. In particular note the ventral positioning of the testes and the ovary that lie just above the ventral nerve cord. ne: ventral nerve cord, ov: ovary and te: testis.

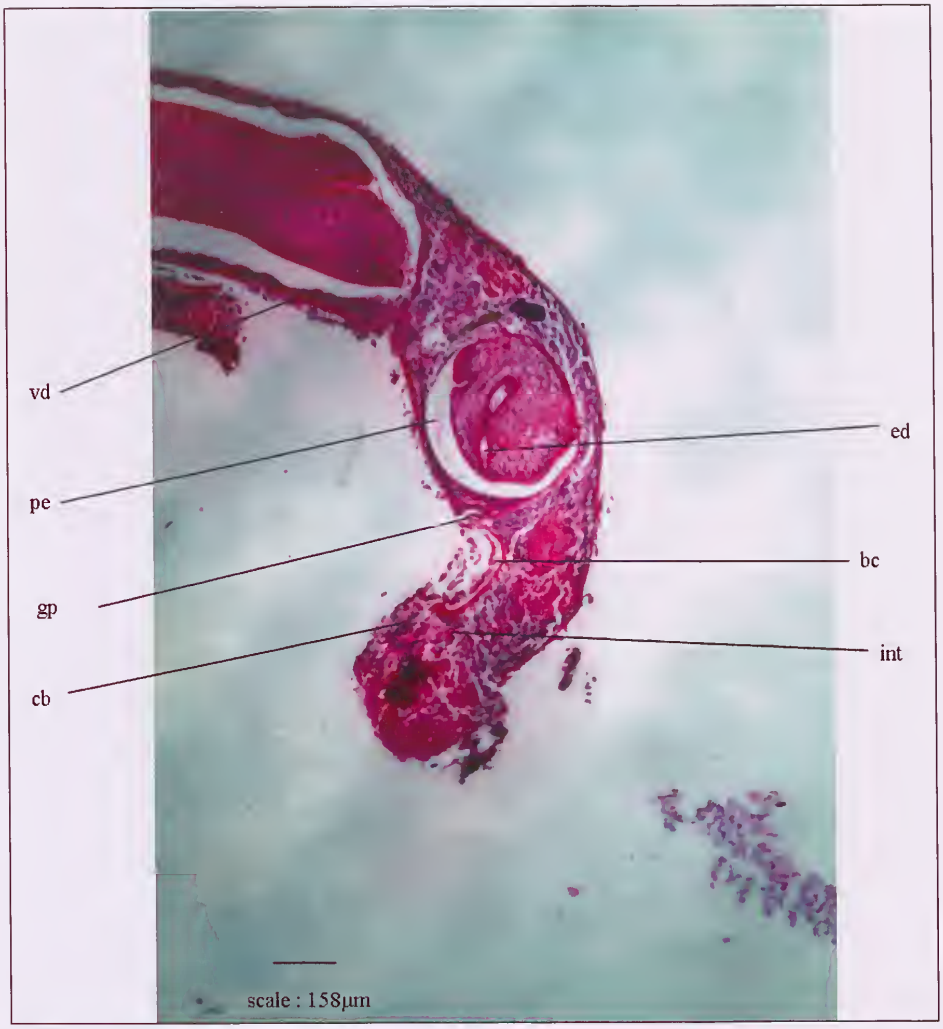

FIGURE 8.
Saggital section of the copulatory organs of *Romankenkius pedderensis* viewed from the left side. Note the absence of a prostatic vesicle. bc: bursal canal, cb: copulatory bursa, ed: ejaculatory duct, gp: gonopore, int: intestine, pe: penis and vd: vas deferens.

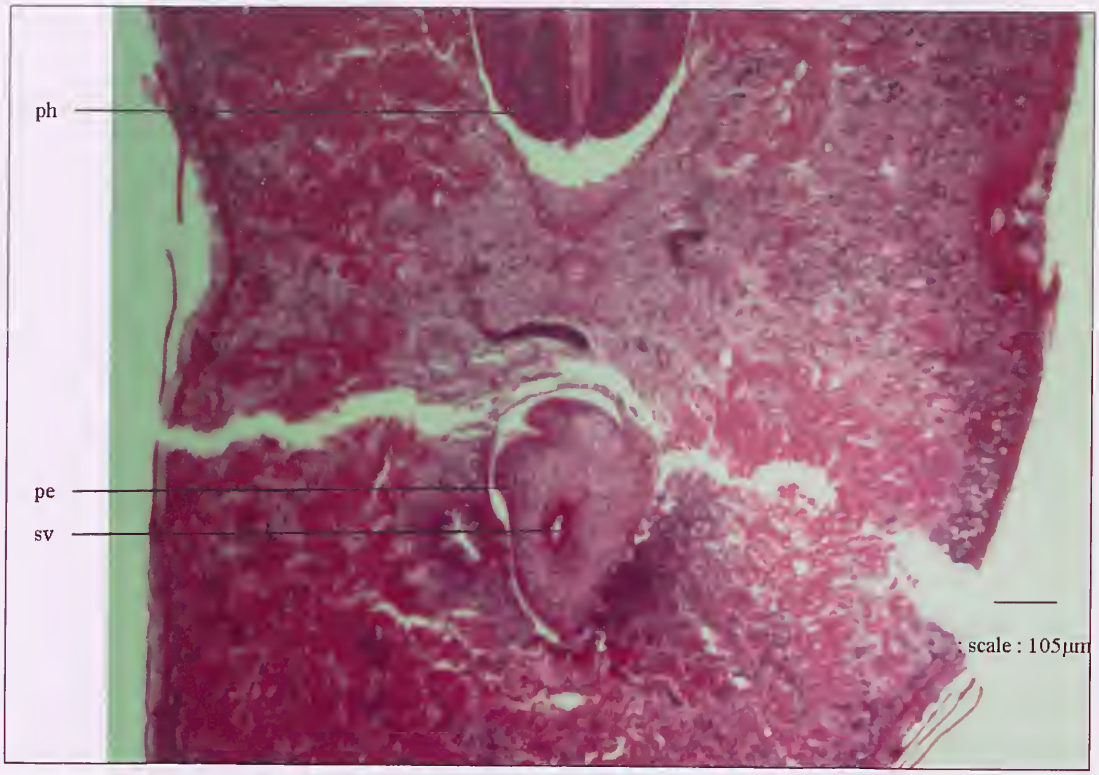

FIGURE 9.
Horizontal section through the copulatory apparatus of *Romankenkius pedderensis* viewed from the ventral aspect. Note the absence of a prostatic vesicle. pe: penis, ph: pharynx and sv: seminal vesicle.

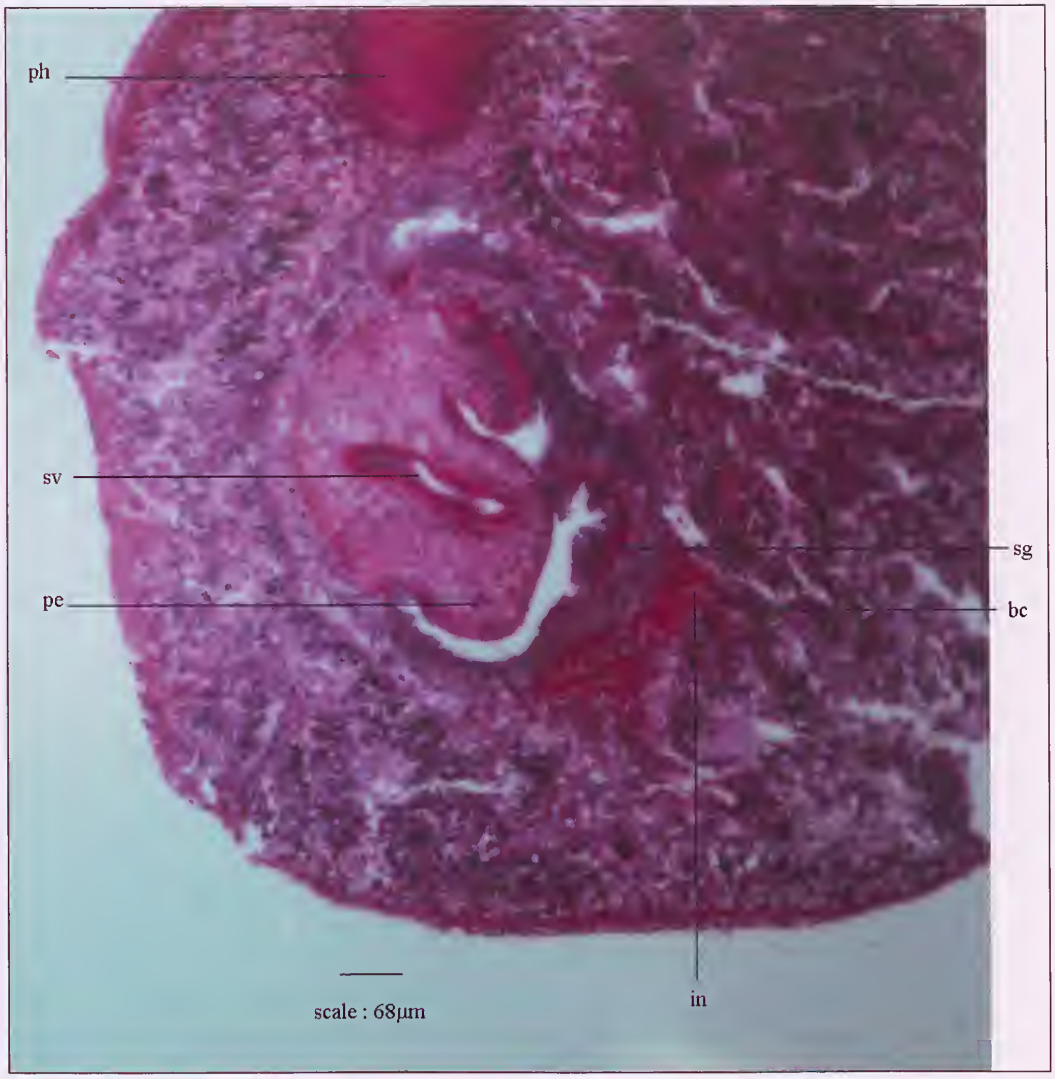

FIGURE 10.
Horizontal section of the copulatory apparatus of *Romankenkius pedderensis* viewed from the dorsal aspect. Note intestine entering copulatory bursa. bc: copulatory bursa, in: intestine, pe: penis, ph: pharynx, sg: shell gland and sv: seminal vesicle.

FIGURE 11.
A living specimen of *Romankenkius pedderensis*. Note the (i) small un-pigmented area surrounding each eye, (ii) presence of pit-like auricular slits and (iii) eyes that are relatively close to the anterior margin of the animal. Approximately 16 mm long.

FIGURE 12.
A living specimen of *Romankenkius pedderensis*. Note the (i) small un-pigmented area surrounding each eye, (ii) presence of pit-like auricular slits and (iii) eyes that are relatively close to the anterior margin of the animal. Approximately 16 mm long.

PLATE 1.
Lake Pedder as it appears today when looking toward the Coronet Range form the southern shoreline. Between the near and far shorelines one traverses the bed of the original Lake Pedder.